

OBSERVATIONS ON AEDES NIPHADOPSIS DYAR &
KNAB AND CAMPESTRIS DYAR & KNAB
IN NEVADA¹
(Diptera: Culicidae)

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The writer has had considerable opportunities to observe these vernal species in Nevada from 1959-61 since they fill the vacuum or void that exists in *Aedes* mosquitoes between the first hint of very early spring (January) to the first production of irrigation mosquitoes in later April. Although a few investigators have written on the biology and ecology of these two species, especially *A. campestris* Dyar & Knab, some of the data do not agree with those obtained in Nevada.

AEDES NIPHADOPSIS Dyar & Knab

This species is known from the great basin of Utah, southern and central Idaho, southern Oregon, and eastern Nevada (Rees and Collett 1954) (Carpenter and LaCasse 1955). Collections were also made in Uinta County, Wyoming, by Roth and Eddy (unpublished data 1960) of the Entomology Research Division, U.S. Department of Agriculture. Richards *et al.* (1956) reported it in Nevada from Esmeralda and Eureka Counties, and more recently the writer found it very abundant in Churchill, Lyon, and Washoe Counties but less prevalent in Douglas County. These counties are more western than eastern.

Aedes niphadopsis Dyar and Knab is the first *Aedes* to appear in the spring. Larvae were observed as early as January 13 and the aquatic stages are usually present to mid-April. It has a single generation each year and the length of the aquatic cycle usually ranges from about four to six weeks depending on the temperature. In Utah the principal hatch begins in the middle of April and is completed about the last of May (Rees and Collett 1954).

Breeding sites were moderate to highly alkaline pools, ponds, seep areas, sinks, and lake margins in the valleys. Water from 108 suspected aquatic habitats of *niphadopsis* and *campestris* was analyzed for pH and total soluble salts. *Aedes niphadopsis* occurred in 103 of those samples which possessed a mean pH of 7.9, rang-

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ing from 7.1-9.3. The total soluble salts ranged from 1,250 to 49,350 ppm, with a mean of 11,781 ppm. *A. niphadopsis* was the most prevalent species in 78 of the 108 potential breeding sites examined. Associated species were *A. campestris*, *dorsalis* (Meigen), and *Culiseta inornata* (Will.), especially the first species. When *A. niphadopsis*, *campestris*, and *dorsalis* occurred in the same pool, *niphadopsis* larvae were generally in more advanced instars and the adults emerged before the other species. The aquatic stages of *campestris* invariably matured before those of *dorsalis*.

Two adjacent sites contained no mosquito larvae but apparently possessed adequate vegetation for egg deposition and larval protection and had total soluble-salt readings of 67,200 and 71,680 ppm. Possibly these readings exceeded the tolerance of these vernal mosquito species. In Utah, Rees and Collett (1954) reported that *A. niphadopsis* occurred in waters with a pH ranging from 7.1-8.2, with an average of 7.6, and in a salt concentration as high as 10% by weight (100,000 ppm.). They also stated that it is a persistent and vicious biter of domestic livestock, other animals, and man. The writer has had very little success inducing *niphadopsis* females to attack during the day in the field although tremendous larval populations were present and adults were quite abundant in the vegetation in the vicinity of their breeding sites. The few females that did feed were collected in vials (20 mm in diameter and 93 mm in length) and held for oviposition in the laboratory at about 75° F., according to the technique of Barr and Al-Azawi (1958). They laid from 35-55 eggs per female.

Autogeny is herein reported for the first time for *A. niphadopsis*. Adults obtained from field collected pupae were retained in cages (9 × 9 × 11 inches), supplied with sugar and honey water, dried raisins, apple slices, and provided with absorbent cotton and balls of cheesecloth moistened with water from their breeding sites for oviposition. Distilled water and water from the breeding sites were also provided in open dishes. Field populations were checked for autogeny from three areas: Winnemucca Lake and Gerlach in Washoe County and Hazen in Churchill County. A few eggs were deposited, probably only from one individual, in the several hundred mosquitoes from the Winnemucca Lake area. Almost 100 eggs were deposited by about 400 *niphadopsis* collected in the Gerlach area. A much larger sample of pupae was collected

from the Hazen area and many of the females deposited hundreds of eggs both on the moistened absorbent cotton and the balls of cheesecloth. Some eggs were also collected from open dishes of water. Deposition started about 10 days following emergence. None of these eggs hatched after being conditioned and subjected to a hatching stimulus (one part of strained corn juice to 100 parts of distilled water).

The only report on the biology of *niphadopsis* states that "under optimum laboratory conditions, with a mean temperature of 72° to 75° F., the length of time required to complete the life cycle from first instar larvae to adult was 23 days. The length of time spent in each of the first three larval stages was similar, extending slightly over 72 hours for each, while the fourth instar larvae lasted approximately 10 days. The pupal stage required approximately 72 hours." (Reese and Collett 1954)

These data are not compatible with information obtained in our Reno laboratory at about the same temperature (75° F.), especially the stadium of the fourth-instar larva. Newly hatched first-instar larvae were brought into the laboratory, supplied with food, and reared in aerated water. The aquatic cycle from first-instar larva to adult was completed in a minimum of 14 days. The first three instars and the pupal stage each lasted 2-3 days, whereas the fourth instar required 4-5 days.

Comb scales of *niphadopsis* are said to vary from 8-12, but the writer has observed fourth-instar larvae with comb scales ranging from 6 to 17. One or more apical pecten teeth are said always to be detached and this character is usually used to delimit this species in keys (Carpenter and LaCasse 1955, Stage *et al.* 1952). Many larvae from Nevada do not have detached pecten teeth but the pecten teeth in all specimens examined extended about one-fourth the length of the siphon which is characteristic of this species.

AEDES CAMPESTRIS Dyar & Knab

This species has a much wider distribution than its congener *A. niphadopsis* and is known from Canada, Alaska, Colorado, Idaho, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, Wisconsin, and Wyoming (Carpenter and LaCasse 1955). In Nevada

Richards *et al.* (1956) reported it from Churchill, Mineral, Nye, and White Pine Counties. In addition, the writer has found it in Douglas, Elko, Eureka, Lyon, and Washoe Counties; abundant larval and adult populations were observed in Churchill, Lyon, and Washoe Counties.

Although larvae of *campestris* were observed as early as February 5, the main brood occurs in March and April. Adults emerge in late April and May. Companion species were *niphadopsis*, *dorsalis*, and *Culiseta inornata*. Breeding sites were the same as those enumerated for *niphadopsis*. Of the 108 suspected breeding sites, *campestris* was present in 61 among which the pH of the water ranged from 7.1-9.1, with a mean of 7.9. The total soluble salts of these samples ranged from 1,250 to 30,720 ppm, with a mean of 10,352 ppm. *Aedes campestris* breeding was absent in six areas with total soluble salts in excess of 31,000 ppm and which contained larvae of *niphadopsis*. *Aedes campestris* was the dominant species in only 21 of the 108 samples and *dorsalis* predominated in the remaining 9 sites.

Biting adults of *campestris* are very annoying in the vicinity of their breeding grounds and are both diurnal and nocturnal pests of man and animals. Numerous specimens of both sexes visited the blossoms of wild radish (*Raphanus sativus* L.) and horse brush (*Tetradymia glabrata* Gray) during mid-day.

With the exception of a report by Rempel (1953), who mentions a possible second brood in Saskatchewan, and McGregor and Eads (1943), who recorded multiple generations in Texas, most investigators believe *campestris* to be a univoltine species (Rees 1943, Owen and Gerhardt 1957, Barr 1958). In 3 years the writer has collected *campestris* larvae in Nevada only twice, other than in the spring. A few larvae were collected once in early December and a large brood of *campestris* and *dorsalis* were observed in several large alkaline areas in June following an unusual summer storm which deposited over an inch of precipitation. These areas had produced first a large brood of *niphadopsis* in March and then *campestris* in May after which the areas dried up in late May. Although it is possible that some of the *campestris* eggs that hatched in June were eggs from the year before that failed to hatch during the first spring flooding, the writer believes the preponderance of the June brood was derived from eggs laid by the

preceding spring generation. Although the areas contained many eggs of *niphadopsis*, no larvae were collected during June.

In 1961 biting *campestris* females were field collected in vials as described for *niphadopsis* and retained in the laboratory for oviposition at about 75° F. and 65% relative humidity. Ten females oviposited 5-10 days after a blood meal. The number of eggs per female ranged from 120-330, with a mean of 269. One female fed a second time and laid a second batch of 179 eggs. Approximately one day after oviposition eggs were placed on moist filter paper in petri dishes. Twenty eggs from each of eight females were subjected to a hatching stimulus (as described for *niphadopsis*) when approximately one-week-old and 53% hatched. Similar tests with 20 three-week-old eggs from each of 10 females resulted again in a 53% hatch. Up to 95% of the eggs from some females hatched and the total hatching percentage would have been much higher except for the very few numbers that hatched from three females each time. Similar hatching results were obtained in 1960. These results indicate that although *campestris* is actually a multivoltine species, it usually behaves as a univoltine species in Nevada because of ecological and climatological conditions. For example, there may be a lack of precipitation and the breeding sites may be flooded only once a year in the winter or early spring; or the sites may remain inundated the year around with enough fluctuation of water along the shoreline to stimulate egg hatching of both *campestris* and *niphadopsis*.

The aquatic cycle of *campestris* from first-instar larva to adult was completed in a minimum of 11 days in the laboratory at about 75° F.

Several thousand pupae were collected from Hazen in Churchill County and reared (as described for *niphadopsis*) in a cage (12 × 12 × 18 inches). Hundreds of autogenous eggs were deposited beginning 10 days following emergence. The eggs were laid singly and in groups on absorbent cotton, balls of cheese cloth, and on brown paper toweling, in petri dishes, all of which were kept moist with water from breeding areas. No eggs were deposited in open dishes of distilled water, contrary to observations reported by Beckel (1955) in Canada. No hatching of autogenously produced eggs was noted.

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RELEASES OF RECENTLY IMPORTED INSECT PARASITES
AND PREDATORS IN CALIFORNIA, 1960-61

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The following list, reporting the first field release of certain imported species of parasites and predators by the Department of Biological Control, supplements preceding biennial reports be-